Quitting cigarettes completely or switching to smokeless tobacco: do US data replicate the Swedish results?

S-H Zhu,1 J B Wang,1 A Hartman,2 Y Zhuang,1 A Gamst,1 J T Gibson,3 H Gilljam,4 M R Galanti4

ABSTRACT

Background: Swedish male smokers are more likely than female smokers to switch to smokeless tobacco (snus) and males’ smoking cessation rate is higher than that of females. These results have fuelled international debate over promoting smokeless tobacco for harm reduction. This study examines whether similar results emerge in the United States, one of few other western countries where smokeless tobacco has long been widely available.


Population-weighted rates of quitting smoking and switching to smokeless tobacco were computed for the 1-year period.

Results: Among US men, few current smokers switched to smokeless tobacco (0.3% in 12 months). Fewer former smokers turned to smokeless tobacco (1.7%). Switching between cigarettes and smokeless tobacco, infrequent among current tobacco users (<4%), was more often from smokeless to smoking. Men quit smokeless tobacco at three times the rate of quitting cigarettes (38.8% vs 11.6%, p<0.001). Overall, US men have no advantage over women in quitting smoking (11.7% vs 12.4%, p = 0.65), even though men are far likelier to use smokeless tobacco.

Conclusion: The Swedish results are not replicated in the United States. Both male and female US smokers appear to have higher quit rates for smoking than have their Swedish counterparts, despite greater use of smokeless tobacco in Sweden. Promoting smokeless tobacco for harm reduction in countries with ongoing tobacco control programmes may not result in any positive population effect on smoking cessation.

One of the most controversial issues in the debate on tobacco harm reduction is whether the public health community should promote smokeless tobacco as a safer alternative to smoking. Proponents of the idea argue that many smokers cannot or will not quit. Thus, encouraging them to switch to smokeless tobacco products, which are less harmful than cigarettes even though still carrying significant health risks, would reduce the overall disease burden of tobacco use.1–4 Those who oppose or have reservations about wider use of smokeless tobacco are concerned that promoting smokeless tobacco as a safer product would dilute the overall anti-tobacco message,4–7 creating a negative net impact compared to continuing current, proved tobacco control strategies.7 It is difficult to gauge the likelihood of either scenario because both arguments involve assumptions about population behaviour, and empirical data to verify them are hard to obtain.

The strongest population data so far have come from one country, Sweden. A particular smokeless tobacco product, snus, long popular among Swedish males, enjoyed a major sales increase beginning in the 1970s.9–11 Studies have found the increased use of snus among Swedish men is associated with a greater drop in smoking prevalence among men than among women.11 12 This drop is further credited with contributing to a faster than expected drop in men’s lung cancer rate.11 The harm reduction effects of snus in Sweden appear strong. It would seem logical to encourage harm reduction via smokeless tobacco in other countries as well.

There are, however, difficulties in directly applying the Swedish results to other countries. Many have cautioned that the Swedish results could be a country-specific phenomenon because of unique historical and cultural factors associated with snus use.13–15 Cultural differences notwithstanding, there are conceptual ambiguities involved in interpreting the results. First, it is not well quantified how much of the greater drop in smoking prevalence among Swedish men comes from current smokers switching to snus and how much from new tobacco users taking up snus instead of cigarettes.14 Second, it is unclear how much of the increased use of snus is the result of price; snus traditionally costs far less than cigarettes.15 Third, it is unclear how much of the increase in snus use is related to smokers’ perception that snus is safer, since safety has historically not been the chief promotional message for snus in Sweden.9 16 17 If the increase in use is mainly a response to price differential, or to social or cultural factors beyond a perception of harm reduction, then applicability of the Swedish results to other countries becomes uncertain.

An added difficulty in assessing international implications of the Swedish data is the dearth of relevant data from other countries. Sale of smokeless tobacco is banned in Australia, New Zealand and European Union countries other than Sweden, so there is little usage data on which to base predictions. In Norway, a non-EU country with no ban, snus use is increasing.18 In the United States, where there is no ban and the tobacco industry promotes all tobacco products, the prevalence of use of smokeless tobacco has declined along with

smoking, until very recently. These conflicting data make it hard to predict the results of promoting smokeless tobacco as a safer alternative to cigarettes, especially if the message were to come from public health authorities as well as from the tobacco industry.

The present study aims to provide empirical results to facilitate the discussion by examining data from the United States, where smokeless tobacco products have long been widely available, as in Sweden. The study focuses on the relation between the use of smokeless tobacco and smoking cessation.

To put the study in perspective, it is important to articulate the logic behind the claim that snus helps Swedish smokers quit smoking. To summarise: In Sweden, snus is far more popular among men than among women. Assuming that the need for nicotine is the chief cause of relapse, men should have an advantage over women in quitting smoking, because snus gives men an alternative source of nicotine. However, if cessation of both smoking and snus is considered, men and women should show similar rates. Therefore, a key test for the snus effect would be two-pronged: a sex difference in smoking cessation rates and a lack of sex difference in total tobacco cessation rates. These are precisely the results found in a longitudinal study based on the well-known MONICA project in northern Sweden. The annual smoking cessation rate, averaged over many years of follow-up, was 50% higher for male smokers than for female smokers (6.0% vs 4.1%). However, the annual quit rate for both cigarettes and snus was no different for males and females (3.8% vs 3.6%). A longitudinal study in southern Sweden, where the sex difference in snus use is less pronounced than in the north, also found that a significantly higher proportion of males than females quit smoking (50% higher for males). These results support the position that snus helps Swedish men quit smoking. Finding similar data patterns from other countries would suggest that smokeless tobacco could also have the same effect in those countries.

We analyse newly available longitudinal data based on a US national survey: the Tobacco Use Supplement (TUS) to the Current Population Survey (CPS). The longitudinal design allows examination of both switching and quitting at the population level, avoiding some of the methodological pitfalls of cross-sectional studies. The present study asks three related questions. First, how many US smokers switch from smoking to smokeless tobacco in a given year? Second, since use of smokeless tobacco in the United States is chiefly a male behaviour, is men’s smoking cessation rate significantly higher than women’s? Third, are sex differences in cessation rate, if any, sustained when the analysis considers quitting both cigarettes and smokeless tobacco?

**METHODS**

**Data sources**

The TUS-CPS is a series of large US national household surveys administered by the Census Bureau for the National Cancer Institute (NCI), providing data on tobacco use behaviour. The CPS, a monthly Census Bureau survey for the Bureau of Labor Statistics, uses a multistage stratified area probability sample of households for the civilian non-institutionalised population ≥15 years old. The TUS-CPS is conducted with eight panel rotations in three waves, each covering all 50 US states.

The present study used a longitudinal sample between two TUS-CPSs: TUS-CPS 2002, which collected data in June 2001, November 2001 and February 2002, and TUS-CPS 2003, which collected data in February, June and November 2003. Owing to the rotating panel design of the CPS, a third of those interviewed in February 2002, across all US states, were interviewed again in February 2003. This creates a unique opportunity for examining tobacco use behaviour with a longitudinal study design of 1 year’s duration, based on a national sample.

Detailed methodology for the TUS-CPS sampling design can be found in web-accessible technical reports. The response rate for TUS-CPS 2002 was 82.5%. However, 22.5% of these surveys were answered by proxy (someone in the same household as the person selected for interview). Our analysis focuses on the 2002–3 longitudinal portion. It excludes proxies, respondents under age 18, and those who reported being current smokers under age 18, and those who reported being current smokers.

**Table 1** Demographics of study sample at baseline (2002)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Cigarettes only (%) (95% CI)</th>
<th>Smokeless only (%) (95% CI)</th>
<th>Cigarettes and smokeless (%) (95% CI)</th>
<th>Neither cigarettes nor smokeless (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 2565)</td>
<td>(n = 258)</td>
<td>(n = 53)</td>
<td>(n = 12 116)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>53.1 (51.0 to 55.2)</td>
<td>91.7 (85.5 to 95.4)</td>
<td>92.8 (80.0 to 97.6)</td>
<td>45.8 (45.2 to 46.4)</td>
</tr>
<tr>
<td>Female</td>
<td>46.9 (44.8 to 49.0)</td>
<td>8.3 (4.6 to 14.5)</td>
<td>7.2 (2.4 to 20.0)</td>
<td>54.2 (53.6 to 54.8)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–24</td>
<td>12.0 (9.9 to 14.5)</td>
<td>8.3 (3.7 to 17.6)</td>
<td>10.1 (3.1 to 28.3)</td>
<td>11.6 (10.9 to 12.3)</td>
</tr>
<tr>
<td>25–44</td>
<td>46.1 (43.4 to 48.8)</td>
<td>55.1 (46.0 to 64.0)</td>
<td>62.5 (53.5 to 77.0)</td>
<td>39.9 (39.1 to 40.6)</td>
</tr>
<tr>
<td>45–64</td>
<td>34.3 (32.0 to 36.7)</td>
<td>23.4 (17.2 to 31.1)</td>
<td>22.4 (12.4 to 37.0)</td>
<td>31.3 (30.6 to 31.9)</td>
</tr>
<tr>
<td>65+</td>
<td>7.6 (6.5 to 9.0)</td>
<td>13.1 (8.1 to 18.6)</td>
<td>5.0 (0.7 to 28.2)</td>
<td>17.3 (16.9 to 17.8)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>78.5 (76.3 to 80.5)</td>
<td>88.5 (77.8 to 92.2)</td>
<td>85.8 (71.3 to 93.6)</td>
<td>70.7 (70.0 to 71.5)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>7.5 (6.0 to 9.6)</td>
<td>3.6 (1.2 to 10.5)</td>
<td>3.2 (0.7 to 12.9)</td>
<td>12.5 (12.0 to 13.2)</td>
</tr>
<tr>
<td>Black</td>
<td>11.2 (9.7 to 12.9)</td>
<td>8.2 (4.4 to 14.7)</td>
<td>5.7 (1.2 to 23.5)</td>
<td>11.5 (11.0 to 12.0)</td>
</tr>
<tr>
<td>Asian</td>
<td>1.8 (1.1 to 2.8)</td>
<td>0.0</td>
<td>0.0</td>
<td>4.7 (4.2 to 5.1)</td>
</tr>
<tr>
<td>American Indian</td>
<td>1.0 (0.6 to 1.7)</td>
<td>1.7 (0.6 to 5.1)</td>
<td>5.3 (1.3 to 19.3)</td>
<td>0.6 (0.4 to 0.8)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12</td>
<td>57.5 (54.7 to 60.3)</td>
<td>60.1 (51.4 to 68.3)</td>
<td>63.4 (44.9 to 78.6)</td>
<td>43.6 (42.2 to 44.0)</td>
</tr>
<tr>
<td>&gt;12</td>
<td>42.5 (39.7 to 45.3)</td>
<td>39.9 (31.7 to 48.7)</td>
<td>36.7 (21.4 to 55.1)</td>
<td>56.4 (55.1 to 57.8)</td>
</tr>
</tbody>
</table>

All percentages weighted by population parameters.
smokers in 2002 but then stated that they had never smoked when surveyed in 2003 (1.9% of the sample). This results in an effective sample size of 15,056 for the longitudinal analysis.

The exclusion of proxies from the analysis is based on the consideration that their report of tobacco use is less accurate when they are reporting on smokers who consume cigarettes on a non-daily basis or who have recently quit. This inaccuracy can lead to a bias in estimation of quit rates because it affects both the number considered smokers in the baseline survey (the denominator) and the number considered quitters in the follow-up survey (the numerator). It should be mentioned, however, that the inclusion of proxies does not change the results of this study (interested readers can download the data from the cited sources and repeat the analytical procedure outlined below, with proxies included). Since most cessation studies exclude proxies, this study chooses to exclude them also, to avoid complicating the main question: Do smokers switch to smokeless tobacco?

**Measures**

Smokers are defined as “having smoked at least 100 cigarettes in their lifetime” and at the time of the survey “smoking cigarettes every day or some days.” Smokeless tobacco users are defined as “using chewing tobacco or snuff every day or some days” at the time of survey. Thus, tobacco users are categorised into three groups: cigarette smokers only; users of smokeless tobacco only; and dual users.

Non-smokers are grouped into never-smokers (“never smoked 100 cigarettes in their lifetime”) and former smokers (“smoked at least 100 cigarettes in their lifetime but not smoking at all at time of survey”). Because history of smokeless tobacco use was not well assessed, we created no subgroups for respondents not using smokeless tobacco at the time of survey.

In the longitudinal sample, tobacco use status could change from 2002 to 2003. A change from “yes” to “no” in response to tobacco use questions is defined as having quit. A tobacco user in 2002 could have quit smoking, quit using smokeless tobacco or quit both in 2003. Similarly, 2002 non-smokers could become smokers, smokeless tobacco users or dual users in 2003.

**Analysis**

All results were analysed separately for males and females. Percentages were weighted by census-derived weights for the appropriate survey years. Confidence intervals were obtained with the jack-knife method, with the special replicate-weights developed for the longitudinal 2002–2003 TUS-CPS. All computations were performed with SAS 9.1 and confidence intervals estimated with SUDAAN 9.1.

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**Table 2** Changes in cigarette and smokeless tobacco use among US current tobacco users from 2002 to 2003, by sex

<table>
<thead>
<tr>
<th>2002 Status</th>
<th>2003 Status</th>
<th>Cigarettes only (%) (95% CI)</th>
<th>Smokeless only (%) (95% CI)</th>
<th>Cigarettes and smokeless (%) (95% CI)</th>
<th>Neither cigarettes nor smokeless (%) (95% CI)</th>
<th>Quit cigarettes (%) (95% CI)</th>
<th>Quit smokeless (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes only</td>
<td>1105</td>
<td>86.2 (83.1 to 88.9)</td>
<td>0.3 (0.1 to 0.8)</td>
<td>2.2 (1.4 to 3.5)</td>
<td>11.3 (8.7 to 14.2)</td>
<td>11.6 (9.1 to 14.6)</td>
<td>-</td>
</tr>
<tr>
<td>Smokeless only</td>
<td>234</td>
<td>3.9 (1.4 to 10.6)</td>
<td>59.4 (50.6 to 67.7)</td>
<td>1.8 (0.6 to 5.5)</td>
<td>35.0 (27.0 to 43.8)</td>
<td>-</td>
<td>38.8 (30.5 to 47.9)</td>
</tr>
<tr>
<td>Cigarettes and smokeless</td>
<td>48</td>
<td>37.0 (23.2 to 53.4)</td>
<td>4.9 (0.9 to 23.1)</td>
<td>45.0 (29.7 to 61.3)</td>
<td>13.1 (4.9 to 30.7)</td>
<td>18.0 (7.9 to 36.2)</td>
<td>50.1 (34.5 to 65.7)</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes only</td>
<td>1394</td>
<td>87.6 (85.2 to 89.7)</td>
<td>0.1 (0.0 to 0.2)</td>
<td>12.3 (10.2 to 14.7)</td>
<td>12.3 (10.2 to 14.7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Smokeless only</td>
<td>24</td>
<td>3.2 (0.2 to 31.5)</td>
<td>52.7 (27.4 to 76.7)</td>
<td>0</td>
<td>44.1 (22.2 to 68.6)</td>
<td>-</td>
<td>47.3 (23.4 to 72.6)</td>
</tr>
<tr>
<td>Cigarettes and smokeless</td>
<td>5</td>
<td>71.6 (14.0 to 97.5)</td>
<td>0.0</td>
<td>28.4 (2.5 to 86.0)</td>
<td>0</td>
<td>0</td>
<td>71.6 (14.0 to 97.5)</td>
</tr>
</tbody>
</table>

All percentages weighted by population parameters.

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**RESULTS**

Table 1 reports the demographic characteristics of the study sample at baseline, grouped into exclusive smokers, exclusive smokeless tobacco users, dual users and non-users. The sex difference is most notable among smokeless tobacco users: over 90% were male. Smokeless tobacco users also tended to be younger, white and less educated.

Among male tobacco users in 2002, 83.0% were exclusive smokers and 17.0% used smokeless tobacco (14.1% exclusive smokeless tobacco users and 2.9% dual users). Among female tobacco users, 98.0% were exclusive smokers, 1.7% exclusive smokeless tobacco users and 0.3% dual users (data not shown in table 1).

Table 2 shows changes in tobacco use from 2002 to 2003, by sex. Among males who exclusively smoked cigarettes in 2002, 86.2% still exclusively smoked cigarettes in 2003, and 0.3% had quit smoking and switched to smokeless tobacco. Another 2.2% became dual users. The rest, 11.5%, quit cigarettes and used no smokeless tobacco. If only quitting smoking is considered, then 11.6% had quit by 2003 (italics in table).

Among males using only smokeless tobacco in 2002, 59.4% continued exclusive use in 2003, and 3.9% quit smokeless tobacco and switched to cigarettes. Another 1.8% became dual users. The rest (95.0%) quit smokeless tobacco and used no cigarettes. If only quitting smokeless tobacco is considered, then 38.8% had quit.

Among males using both cigarettes and smokeless tobacco in 2002, 45% continued to use both. Of the rest, 37.0% continued smoking but quit smokeless tobacco, 4.9% continued using smokeless tobacco but quit smoking and 13.1% quit both smoking and smokeless tobacco. Overall, 18.0% quit smoking and 50.1% quit smokeless tobacco.

Three things stand out in the top panel of table 2. First, the quit rate was significantly lower for smoking than for smokeless tobacco. This held true when comparing exclusive cigarette smokers with exclusive smokeless tobacco users (11.6% vs 38.8%) and for dual users (18.0% vs 50.1%). Second, and related, the data on the diagonal show decreasing stability of tobacco use status: exclusive cigarette use was more stable than exclusive smokeless tobacco use, and exclusive smokeless tobacco use more stable than dual use. Third, quitting one form of tobacco and switching to another was infrequent. If there was a switch, it was more likely to be from smokeless tobacco to cigarettes than vice versa (3.9% vs 0.3%).

The bottom panel of table 2 presents results for females. The data exhibit the same pattern as for males, except that most females were exclusively cigarette smokers. The quit rate for the few females who used smokeless tobacco was significantly lower than for other tobacco users.
DISCUSSION

This longitudinal study of the US population found that few male smokers stopped smoking and switched to smokeless tobacco (0.5% in 1 year) and few former smokers turned to smokeless tobacco (1.7%). If anything, it was more likely for smokeless tobacco users to switch to cigarettes. Smoking was the more stable tobacco use status, as the quit rate for smokeless tobacco was three times higher than for smoking. Men’s smoking cessation rate was no higher than women’s (11.7% vs 12.4%) even though men were much more likely to use smokeless tobacco.

The Swedish data pattern was just the opposite. The rate of switching from cigarettes to smokeless tobacco was greater than the rate of switching from smokeless tobacco to cigarettes, and using smokeless tobacco was the more stable tobacco use status. Moreover, Swedish men were significantly more likely than Swedish women to quit smoking in any given year. Clearly, the Swedish data pattern is not replicated in the United States, even though both countries have a long history of smokeless tobacco use and promotion of smokeless tobacco by tobacco industries.

One reason that the Swedish data pattern is not replicated in the United States could be that in the United States smokeless tobacco has not been promoted as a safer alternative to cigarettes. However, neither has snus been widely promoted in Sweden as safer. In fact, the international scientific community has only recently begun to examine the relative risks. Generally, smokers are uninformed about relative risks, an issue that the public health community still must address.

There has been little documented comparison of the tobacco industries’ strategies for promoting snus in Sweden and smokeless tobacco in the United States. What is clear is that the Swedish tobacco industry succeeded in shifting snus use from a limited segment of the male population in the 1970s to the more general male population by the 1990s. No similar shift has taken place in the United States, perhaps in part because of the product differences between Swedish snus and most US smokeless tobacco products.

Another explanation could be cost differential. In Sweden, until 2008, an average snus user spent about 25% of what an average cigarette smoker spent on tobacco products. The price difference in the United States is much smaller. In the United States, an average smokeless tobacco user spends about 50–60% of what an average smoker spends on tobacco products. If cost is the key factor, then it will become apparent with time, as the increasing cost differential between cigarettes and smokeless tobacco in the United States causes more smokers to switch to smokeless tobacco.

Beyond issues of promotion and cost, one might argue that use of smokeless tobacco must be sufficiently widespread in a given population before smokers will consider switching. The proportion of smokeless tobacco users among all male tobacco users in the United States is low (17%), and more US men might have to be using smokeless tobacco before more smokers will switch to smokeless tobacco. This possibility, admittedly tautological, merits consideration. There are some relevant US data, as the prevalence of use of smokeless tobacco varies widely.
The strength of the present study is its longitudinal design with a national sample. The results are a needed addition to the empirical literature on the harm reduction debate, which has often relied on logical exercises rather than on data when addressing countries other than Sweden. However, the present study has a limited follow-up period (1 year). Future studies with longer follow-up will allow more comprehensive analysis of switching behaviour and better assessment of annual cessation rates. Also, the present study examines the effects of smokeless tobacco use on smoking cessation only, with very limited data on smoking uptake by adult never-smokers (table 3). Future longitudinal studies exploring this issue will be helpful.

The results of the present study of the US population do not directly refute the argument that promoting smokeless tobacco for harm reduction in countries with established tobacco control programmes will result in a large, positive population smoking cessation effect. The argument remains a hypothesis, and it is weakened by these results.

What is already known on this subject

Data from Sweden show that male smokers are far likelier than females to switch to smokeless tobacco (snus) and males’ smoking cessation rate is significantly higher than that for females. These results appear to support the idea of promoting smokeless tobacco in other countries to reduce smoking-related diseases. However, no longitudinal data from other countries have been available to show the relation between smokeless tobacco use and smoking cessation rates outside Sweden.

What this study adds

Analysis of longitudinal data based on a national sample in the United States, one of few other Western countries where smokeless tobacco has long been widely available, found no discernable association between smokeless tobacco use and population smoking cessation rates. These results suggest that country-specific studies are needed before the global public health community engages in promoting smokeless tobacco as a way to increase smoking cessation rates.
Acknowledgements: The authors would like to acknowledge Dr William W Davis of the Statistical Research Applications Branch of the Division of Cancer Control and Population Sciences/NCI for his development of the 2002–2003 overlap sample weights that were used in this study.

Funding: This work was supported in part by a supplemental grant to the University of California, San Diego Cancer Center from the National Cancer Institute (NCI); grant 5 P50 CA 23100-22/24 (to S-HZ). Findings and conclusions are those of the authors and do not reflect the views of the NCI.

Competing interests: HG, on behalf of his institution, has conducted clinical trials on smoking cessation with funding from Pharmacia, Pfizer, Glaxo-Smith-Kline and Sanofi-Aventis and has also received compensation from the above-mentioned companies for lectures on prevention of tobacco use. Other authors declare no competing interests.

Ethics approval: This study has been approved by the ethics committee of the institutional review board, University of California, San Diego, Human Research Protection Program.

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Tob Control 2009 18: 82-87 originally published online January 23, 2009
doi: 10.1136/tc.2008.028209

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